SUMMARY OF HISTORICAL GROUND WATER DATA

Hexcel Facility
Lodi, Bergen County, New Jersey
ISRA Case No. 86009

Prepared for

Hexcel Corporation

Prepared by

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LIST OF ATTACHMENTS

Attachment A:	Ground Water Samples
Attachment B:	Volatile Organic Results
Attachment C:	Polychlorinated biphenyls (PCBs) Results
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SECTION 1: OVERVIEW

This report provides evaluation of the ground water conditions at the Hexcel facility ("the Hexcel site", "the site" or "Hexcel") located at 205 Main Street in Lodi, Bergen County, New Jersey. The ground water conditions have been investigated primarily through the ground water monitor, control and recovery wells installed between 1988 and 1992 pursuant to activities conducted in compliance with the Environmental Cleanup Responsibility Act (ECRA) and the subsequent Industrial Site Recovery Act (ISRA). Subsurface information has been compiled from well logs as well as additional borings drilled in 1995.

1.1 The Nature of the Ground Water Contamination

The principal components of the ground water contamination previously documented at Hexcel are listed below.

- Dense non-aqueous phase liquid (DNAPL),
- Light non-aqueous phase liquid (LNAPL),
- Polychlorinated biphenyls (PCBs), and
- Dissolved concentrations of LNAPL and DNAPL compounds and, more recently, phenolic compounds.

Dense Non-Aqueous Phase Liquid (DNAPL)

DNAPLs are organic liquids which, being heavier than water, tend to sink in water and form a separate layer under water. Organic compounds which can be classified as DNAPLs include chlorinated solvents, halogenated benzenes, phthalates, polychlorinated biphenyls (PCBs), some pesticides, coal tar and creosote.

DNAPL at the Hexcel site is associated primarily with chlorinated solvents and to a lesser degree with PCBs. Additionally, even though DNAPL chemicals are associated with both chlorinated solvents and PCBs, chlorinated solvents are the dominant components of the dissolved concentrations in the ground water.

Chlorinated solvents, for example trichloroethene, chlorobenzene and tetrachloroethene, are regarded as comprising the most important and most prevalent class of DNAPL chemicals and have a wide range of applications in the manufacturing and chemical industries. These chemicals have been detected in the ground water samples collected from the monitoring wells installed by Hexcel. The site was part of the historic United Piece Dye Works and has been operated as a chemical manufacturing facility from the early 1900s until the present under various ownerships. The facility is currently being operated as a chemical facility by Fine Organics Corporation.

Polychlorinated Biphenyls (PCBs)

PCBs are extremely stable, non-flammable, dense and viscous liquids that were marketed under the Aroclor trademark between 1929 and 1977. Each Aroclor is identified by a four-digit number such as 1221, 1232, 1242, 1248, 1254 and 1260 based on its chemical composition. Commercial PCB fluids are a series of mixtures and could consist of one or more Aroclors. PCBs have had a variety of industrial applications including use as hydraulic fluids, dielectric fluids in transformers, plasticizers in rubber, heat transfer mediums, etc. At the Hexcel site, the only known application of PCB fluids was as a heat transfer medium. There was a transformer at the site but it is not known if it used PCB fluids.

Although PCBs are generally classified as DNAPLs, it is possible for PCB compounds to be detected in LNAPLs. At Hexcel, PCBs have been detected both in DNAPL and LNAPL chemical analyses. PCBs have higher densities than water and are, therefore, generally classified as DNAPLs. Sometimes PCBs can become associated with LNAPL compounds, for example, if a PCB source is near a LNAPL source, and the resulting mixture can act as an LNAPL. Additionally, some industrial products consist of both PCBs and LNAPL compounds, for example, some heat transfer fluids are petroleum based with PCBs - in such a case PCBs would act as a LNAPL.

Light Non-Aqueous Phase Liquid (LNAPL)

LNAPLs are organic liquids, lighter than water, which tend to float as separate layers on water. The compounds associated with LNAPL at the site are primarily hydrocarbons (compounds formed with carbon and hydrogen atoms only) like benzene, toluene, ethylbenzene and xylenes (BTEX). BTEX compounds have been detected in the ground water samples collected from the monitoring wells installed by Hexcel.

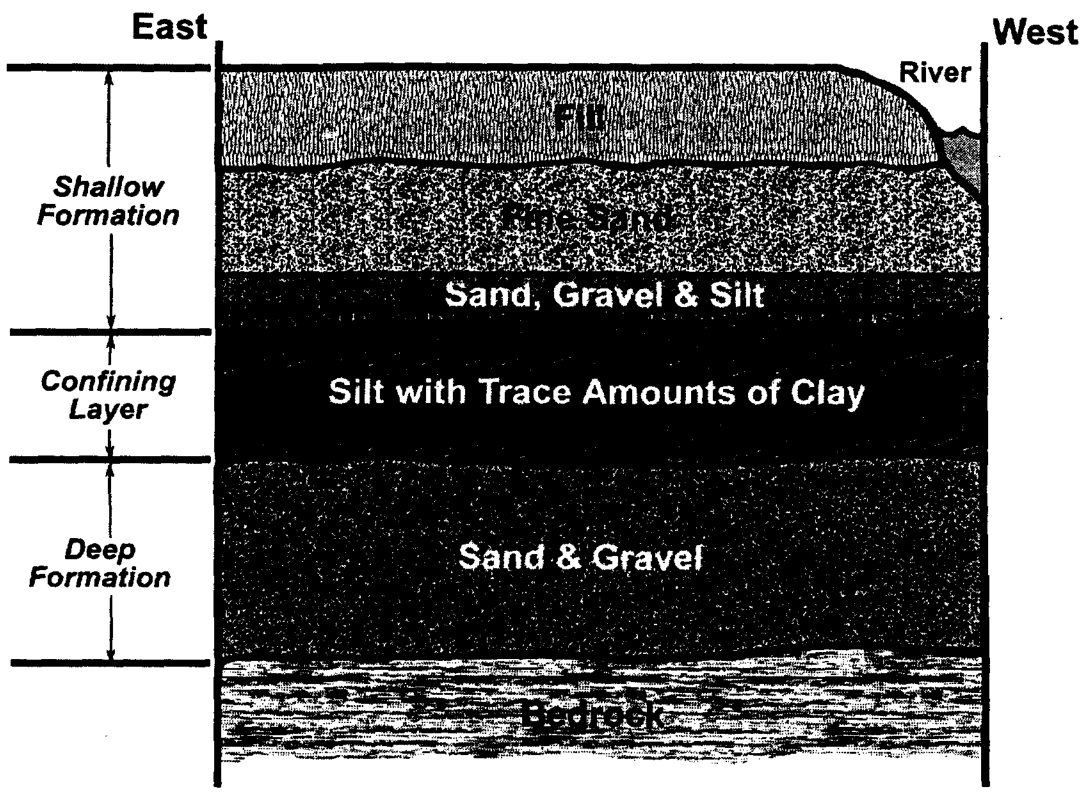
A source of LNAPL may result from subsurface spills or leaks of petroleum products (gasoline, fuel oil, etc.). There were three underground storage tanks present at Hexcel: one 500-gallon gasoline tank, one 4,000-gallon fuel oil tank, and one 2,000-gallon fuel oil tank. The two fuel oil tanks were situated east of Building 1 adjacent to the Boiler Room and the gasoline tank was located north of Building 6 (Figure A1, Attachment A). All of these tanks were observed to be in poor condition with several corrosion holes at the time of their removal in 1991.

Dissolved Concentrations of NAPL Contaminants

A very small amount of the NAPL compound is able to blend uniformly or "dissolve" in water due to its solubility in water. At Hexcel, although dissolved concentrations of both LNAPLs and DNAPLs have been detected in the ground water, DNAPL compounds have been detected in more wells and at higher concentrations than LNAPL compounds.

1.2 Geologic Evaluation

This section provides a general explanation of the geology and the subsurface at the former Hexcel facility. The simplified figure below illustrates the general geology of the site that will be discussed in the following paragraphs.



General Geologic Cross-Section for the Site

The top portion of the subsurface at the site consists of man-emplaced fill material. The site is located along the east bank of the Saddle River. The western portion of the site was submersed under water by an inlet of the river sometime prior to the early 1900s. Sometime during the early 1900s, the submersed portion of the site was filled to make room for industrial development along the Saddle River. The fill, consisting of sand, gravel, brick, cinders and wood, is still present at the site.

Soil immediately beneath the fill consists of fluvial deposits of the Saddle River. Fluvial deposits are materials that are transported and laid down by river or stream action and commonly consist of sand, gravel and silt. The review of the boring logs for the wells and borings installed by GEO Engineering (GEO) indicate that fluvial deposits at the site consist generally of a top layer of fine sand and a bottom layer of sand, gravel and silt. The amounts of sand, gravel and silt in the bottom layer vary over the site. Together, the fluvial deposits and the overlying fill material comprise the shallow formation depicted in the figure above.

Underlying the fluvial deposits is a layer of fine grained sediments characteristically deposited by slow moving waters. At the site, this layer consists mainly of silt with trace amounts of clay. These soils are capable of restricting the flow of ground water. This layer separates the upper (shallow) formation from the lower (deep) formation. The water movement in this confining layer is expected to be negligible compared to the water movement in the formations above and below it.

The formation underlying the confining layer consists of coarse sand and gravel. This deposit is characteristic of glacial outwash deposits. It appears that the outwash deposit at the site extends down to the bedrock. The depth to bedrock is 25 to 30 feet from the ground surface. The water in the deep formation is under confined conditions due to the presence of the confining layer above it and consequently might have higher pressure than the water in the shallow formation at the same location.

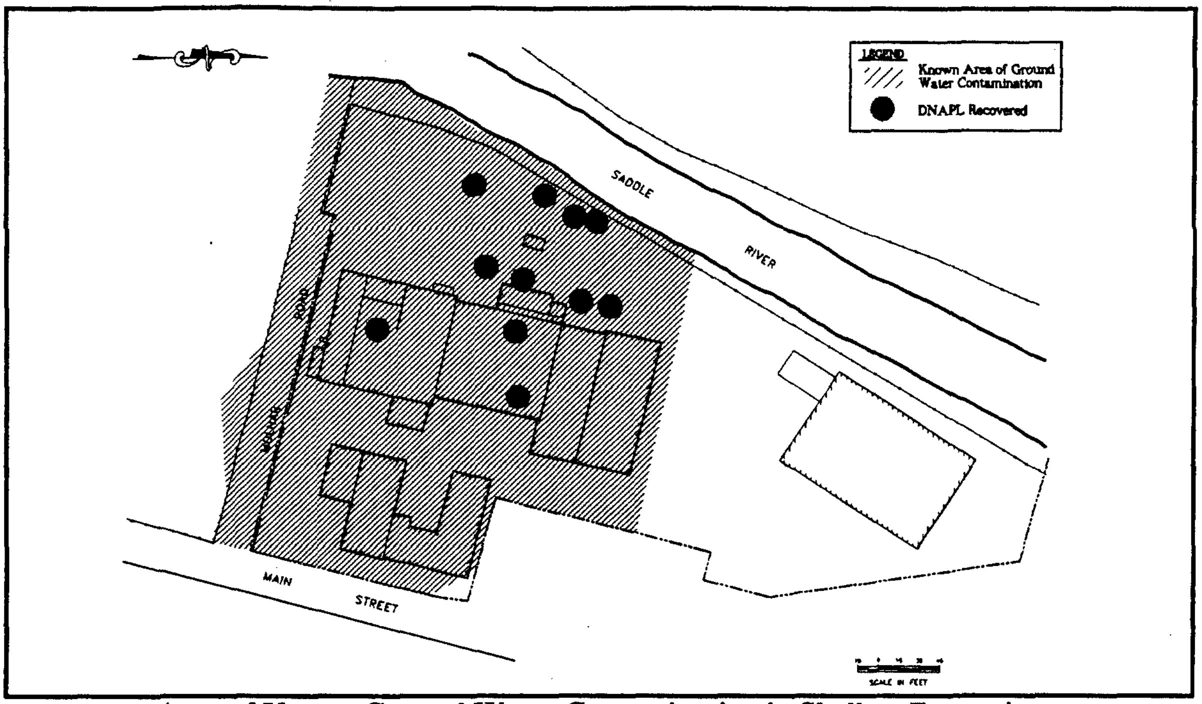
1.3 Assessment of Movement of Ground Water

The general direction of ground water flow in the shallow formation is from the east to the west toward the Saddle River. In the deep formation, the ground water flows from the northeast to the southwest.

The water table at the site is shallow; the depth to water from the ground surface has typically been measured in the range of 3 to 7 feet over the entire site. Much of the shallow formation, including the fluvial deposits above the confining silt layer and portions of the shallow fill, is saturated by ground water. Based on the current subsurface information, it appears that the fluvial deposits in the shallow formation are in connection with the Saddle River channel.

1.4 Evaluation of the Extent of Contamination

Locally, ground water in the shallow formation contains dissolved contaminants. Additionally, free oil product in the form of DNAPL and LNAPL has been recovered from some wells installed in the shallow formation. Based on the available data, the following figure illustrates the area of ground water contamination and known DNAPL locations. The darkened circles are well locations from which DNAPL has been recovered two or more times since October 1990. The hatching indicates the area in which ground water samples from monitor wells have been obtained with dissolved volatile organics concentrations above NJDEP criteria. For wells that have been tested more than once, the most recent sampling data have been used for comparison with the NJDEP criteria.



Area of Known Ground Water Contamination in Shallow Formation

Ground water in the shallow formation is separated from the deep formation by the presence of a silt confining layer, as described earlier. The presence of this silt layer is significant because it inhibits the movement of contaminated ground water and DNAPL. Due to the presence of this layer, the contamination appears to be predominantly limited to the shallow formation.

Dissolved concentrations of NAPL compounds have also been detected in the wells in the deep formation but the details of the construction of these wells are not well documented. The impact to the deep formation is uncertain because of limited ground water data; all of the eight deep wells were tested in 1988 shortly after installation, and six were tested again in 1993. Concentrations detected in the deep formation for the two ground water sampling rounds were typically two to three orders of magnitude lower than the concentrations detected in the shallow formation. No free product has ever been detected in any of the deep wells.

1.5 Regional Background

The Hexcel site is located in a historically industrial area with the presence of manufacturing facilities dating back to the 1800s. The site was part of the historic United Piece Dye Works and has been operated as a chemical manufacturing facility since the early 1900s under various ownerships. At present, there are numerous industries located along the Saddle River in this area.

The site is located adjacent to the east bank of the Saddle River. At present, the NJDEP has designated the Saddle River as an FW-2 stream which is a general surface water classification for the waters of the state of New Jersey. This means that it is not used for potable water at the present.

The entire site has a long history of flooding and falls within a 100 year Flood Hazard Area as designated by the NJDEP, Division of Water Resources. The U.S. Army Corps of Engineers (Army Corps) is currently designing a Lower Saddle River Flood Control Project which is intended to provide flood damage reduction and protection against 150-year frequency flood events. The recommended plan proposes widening and deepening the existing channels to increase channel capacity.

The potential regional contamination related to the industrial and manufacturing background of the region has prompted the Army Corps to conduct an extensive investigation to identify potential areas of contamination. The Army Corps has conducted soil borings and monitor well installations along the Saddle River banks in order to determine the extent of contamination in the area. Although the Army Corps investigation was restricted due to the denial of right of entry into many properties, several potential areas of contamination were identified in the General Design Memorandum prepared by the Army Corps for the flood control project.

The Army Corps assigned a medium, medium to high, or high probability of encountering hazardous, toxic or radioactive waste for numerous sites along the Saddle River. These sites included Napp Technologies, Inc. (Napp) located across Molnar Road from the Hexcel site and various auto detailing and repair shops across the Saddle River. The various auto detailing shops have had numerous instances of spills onto the river banks and have received notices of violations. Napp was a chemical manufacturing and storing facility. Currently, the Napp site is the subject of an environmental investigation being conducted pursuant to the Industrial Site Recovery Act (ISRA).

SECTION 2: DATA EVALUATION

This section provides an evaluation of the results of the testing conducted at the Hexcel site to assess the ground water conditions. The results include characterization of the hydrogeology at the site, evaluation of the ground water analytical data and discussion of source (LNAPL and DNAPL) characteristics. A review of the scope of the past investigations is also presented in the last section of this report.

2.1 Hydrogeology

This section provides greater detail on the subsurface geology and the movement of ground water. These aspects were discussed briefly in Section 1. In this section, boring logs, geological cross-sections and ground water elevation data will be discussed to show the relationship of the subsurface to the flow of the ground water. Laboratory testing results for the geotechnical characteristics of porosity, unit weight and permeability are also provided. All figures associated with this section, including the geological cross-sections, are provided as Attachment H.

The subsurface at the site consists of a shallow (or upper) formation, a deep (or lower) formation and a confining layer which separates these two formations. The shallow formation consists of fill and fluvial deposits (defined below). The confining layer has fine-grained sediments characteristically deposited by still or slow moving water. The deep formation underlying the confining layer has characteristics of glacial outwash deposits yielding large volumes of ground water.

Shallow Formation

The uppermost layer in the subsurface is fill consisting of sand, gravel, small boulders, organic matter and cinders. The fill layer ranges in thickness from 4 to 10 feet over the site. Even though fill has consistently been observed throughout the site, characteristics of fill materials appear to be different in different areas of the site. The fill in the western portion, in the vicinity of the Saddle River, is loose and heterogeneous, consisting of varying amounts of materials cited above. This fill was placed as early as the 1900s to accommodate the growing industries in the area. The approximate average unit weight of this fill is 100 pounds per cubic foot (pcf) and the average porosity is 0.43 based on laboratory testing. The fill in the eastern portion, around the buildings, is mainly fine to medium sand with trace amounts of black cinders. This fill was brought in before or at the time of the construction of the buildings.

Natural fluvial deposits underlay the fill and form the lower part of the shallow formation. Fluvial materials are transported and deposited by rivers or stream action and generally consist of sand, gravel and silt. The review of boring logs indicates that fluvial deposits at the site have two distinct layers. The top layer, immediately under the fill, consists of a fine sand. The tested average unit weight of this uniform sand is 100 pcf and the average porosity is 0.46. The tested permeability of this layer is 10^{-3} cm/sec. The layer underlying the fine sand consists of gravel, sand and silt. The amount of silt, sand and gravel in this bottom layer of fluvial deposits varies over the site. Due to the presence of a wide range of particles in this layer, the average porosity of this layer, at 0.32, is lower than the fine sand layer above it. Consequently, the permeability of this layer is also expected to be lower than that of the fine sand layer. The average unit weight of the bottom layer of the fluvial deposit layer at the site is 126 pcf.

The depth to the water table (ground water in the shallow formation) is typically 3 to 7 feet from the ground surface. Due to the shallow depth of the water table, the ground water saturates the fluvial deposits and portions of the fill across the entire site. Based on the current subsurface information, the Saddle River channel appears to be in hydraulic connection with the fluvial deposits.

Movement of Ground Water

Below we discuss the potential direction of flow at Hexcel, both in the horizontal and vertical directions.

Horizontal Flow

In the shallow formation, the general direction of the ground water flow is from the east to the west toward the Saddle River. The ground water elevation contours for water levels collected in April 1997 are provided in Figure H1. The contours are computer-generated and are based on the water level data collected from the shallow wells installed by Hexcel and from wells installed by Napp on the Napp site.

The contours indicate the presence of a ground water mound in the vicinity of Building 2. A ground water mound typically forms as a result of an inflow of water. This mound indicates a locally altered ground water flow direction, as indicated in Figure H1. The reasons for the mound are presently unknown. In an effort to re-create the mound by use of computer modeling, it was estimated that a constant influx of approximately 1 gallon per minute in this area could lead to such a mound.

In the deep formation, the potential direction of ground water flow is from the northeast to the southwest. Figure H2 provides the ground water contours generated for the water level data collected in April 1997 for the eight deep wells on site.

Ground water elevation data have been collected for the shallow and deep wells since February 1991. Evaluation of the quarterly water level data from October 1994 to the present indicates no significant seasonal fluctuation in the ground water elevations.

Vertical Flow

Another important aspect in the potential movement of ground water is its vertical movement. At Hexcel, there are seven clusters of shallow and deep wells which allow us to evaluate the potential direction of vertical movement of ground water. Evaluation of historical ground water elevation data for the shallow-deep well clusters indicates a downward gradient (potential for ground water to move from shallow formation to the deep formation) of ground water flow in the eastern portion (east of Building 2) of the site and an upward gradient (potential for ground water to move from deep formation to the shallow formation) in the western portion (west of Building 2) of the site. However, movement of ground water will occur only if the soil characteristics are conducive even though a gradient might exist for water movement.

The presence of the silt layer is significant because it inhibits the movement of contaminated ground water and DNAPL. Due to the presence of this layer, the contamination appears to be predominantly limited to the shallow formation. The silt

Confining Layer

Underlying the shallow formation is a layer of fine grained sediments characteristic of materials deposited by still or slow moving waters, for example, a lake deposit (a lacustrine feature). Grain-size analysis indicates that these sediments are mainly silt with trace amounts of clay. This layer acts as a confining layer and separates the shallow formation from the deep formation. The tested permeability of this layer is approximately 4.5×10^{-6} cm/sec. This permeability value agrees with the published range of values of permeability for silt and indicates that this formation restricts water flow. The movement of water in the silt layer is expected to be negligible compared to the formations above and below. The unit weight of this layer is 132 pcf and porosity is 0.34. The known depth to the confining layer from ground surface ranges from 7 feet to 16 feet over the site and the known thickness of the layer varies from 4 feet to 15 feet.

The silt layer is known to exist along the western property boundary (along the Saddle River) and extends eastward toward Main Street. Insufficient information is available to establish the presence or absence of the silt layer near the eastern property boundary and beyond it. No silt layer was reported in the boring log for the off-site well MW-20 (across Main Street from the site) which was drilled to a depth of 20 feet.

Deep Formation

Sediments of the deep formation beneath the confining layer are composed of sand and gravel deposited by glacial processes. This deposit is characteristic of glacial outwash deposits in which coarse sediments are laid down by debris-laden streams formed from meltwater from glaciers. This formation appears to extend down to the bedrock. The range of depth to the bedrock at the site is 25 to 30 feet from the ground surface. Although analyses have not been conducted to evaluate the geotechnical parameters of the deep formation, the porosity and permeability of the formation are expected to be higher than that of the shallow formation based on the composition of the soil.

The subsurface information for the deep formation is based on the logs for the eight deep wells: MW-3, 5, 7, 9, 11, 13, 15 and 19. Review of boring logs and evaluation of site geology has indicated that two wells, MW-1 and MW-26, which had been designated as deep wells at the time of installation were not monitoring the deep formation. MW-1 is on the eastern boundary of the site in the vicinity of Molnar Road and Main Street; MW-26 is in Building 2. For purposes of this report, the ground water analytical data from these two wells have been considered in evaluating the shallow formation.

The water in the deep formation is under confined conditions due to the presence of the confining layer above it and consequently might have higher pressure than the water in the shallow formation. Therefore, if two piezometers or wells are installed in the shallow or deep formation at the same location, the water level could be higher in either of the piezometers.

layer separates the water in the shallow formation from the water in the deep formation and appears to inhibit the spread of ground water contamination and DNAPL into the deep formation. At Hexcel, DNAPL has consistently been recovered from a number of wells installed in the shallow formation but wells installed in the deep formation have not indicated the presence of DNAPL.

2.2 Evaluation Of Ground Water Testing Results

Ground water conditions have been evaluated by testing ground water samples from various monitor, control and recovery wells (these different types of wells are explained in a later section). Table A1 (Attachment A) lists all the ground water samples collected from the wells, the date of the sample and the parameters each sample was tested for. There have been two primary ground water sampling events at the site. The first one was conducted in the period between July 1988 and November 1990 shortly after installation of the wells; the second one was conducted for selected wells in July 1993. More recently, some wells were tested in 1995 after the fire and explosion at Napp. Additionally, two surface water samples from the Saddle River were collected in 1985 and analyzed for all the parameters noted below. The results of these samples are also discussed in this section. The ground water samples have been analyzed for one or more parameters listed below:

- Volatile Organics (VOs)
- Acid-Extractable and Base/Neutral Organics (AEs & B/Ns)
- Priority Pollutant Metals (Metals)
- Total Petroleum Hydrocarbons (TPHs)
- Pesticides and PCBs
- Phenols (Phen)
- Cyanides (Cyan)

The ground water analytical data have been reviewed to evaluate exceedance over the current Ground Water Quality Standards (GWQS, N.J.A.C. 7:9-6 and the Interim Specific Criteria listed by the NJDEP in Rick Gimello's February 5, 1997 memorandum to the Site Remediation Staff) which are the ground water cleanup guidelines presently utilized by the NJDEP. All the results have been presented in the units of μg/L (micrograms per liter). The GWQS are also in μg/L. Below we discuss the ground water results for each of the analytical parameters.

Volatile Organic Compounds

The ground water data for the site indicate that volatile organics are of primary concern in the shallow formation. Compounds classified as chlorinated solvent compounds (e.g., trichloroethene, tetrachloroethene, chlorobenzene, etc.) and petroleum hydrocarbon compounds (benzene, xylenes, etc.) are volatile organic compounds (VOCs). Out of the chlorinated solvent and petroleum hydrocarbons, the chlorinated solvents compounds (associated with DNAPL) are the major components of the shallow ground water contamination. Petroleum hydrocarbon (LNAPL) compounds like benzene, toluene and xylenes have also been detected in the wells.

Dissolved concentrations of NAPL compounds have also been detected in the wells in the deep formation but the details of the construction of these wells are not well documented. The impact to the deep formation is uncertain because of limited ground water data; all of the eight deep wells were tested in 1988 shortly after installation, and six were tested again in 1993. Concentrations detected in the deep formation for the two ground water sampling rounds were typically two to three orders of magnitude lower than the concentrations detected in the shallow formation. No free product has ever been detected in any of the deep wells.

Tables B1 and B2 (Attachment B) provide the VOCs analytical results and exceedances of GWQS for the individual compounds in the shallow and deep wells, respectively.

We have used the total volatile organics concentration data for all the wells collected over time to generate contours. We compared the contours of total VOCs concentrations for data collected between 1992 and 1995 with contours for all the total VOC data (all data collected between 1988 and 1995). The contour patterns for both these data sets were similar. The same was true for contours of total VOC data between 1988 and 1992 and all the total VOC data. Figure B1 (Attachment B) illustrates the known extent of ground water contamination at the Hexcel site along with the total VOC concentration contours.

The comparison of ground water data obtained from the shallow-deep clusters in 1993 is provided in Table B3 (Attachment B). Out of the 6 shallow-deep well clusters tested, the total volatile organic concentrations in one deep well (MW-9) were three orders of magnitude lower than the corresponding shallow well (MW-8) in the shallow-deep cluster. Shallow well MW-8 has historically had DNAPL detected in it occasionally. Three deep wells (MW-5, MW-7 and MW-11) had concentrations two orders of magnitude lower than the corresponding shallow wells (MW-4, MW-6 and MW-10). MW-6 has generally been a consistent source for DNAPL recovery at the site. Only one deep well (MW-3) had total VO concentrations higher than the corresponding shallow well (MW-2). None of the deep wells have ever been found to have free product.

Two samples from the Saddle River were analyzed for volatile organics. Volatile organics were not detected in either of the samples.

PCBs

PCBs have been detected in both DNAPL and LNAPL and at lower dissolved concentrations in the ground water. Aroclor 1242 appears to be the primary form of PCB detected on site. PCBs were detected in exceedance of the ground water cleanup guidelines (0.5 µg/L) in 7 shallow wells out of the 27 shallow wells tested. PCBs were not detected in any of the 6 deep wells tested. PCBs were not detected in the stream samples.

PCB compounds tend to sorb strongly to soil. The tendency of PCB compounds to attach strongly to soils might lead to misinterpretation of the ground water data. Unfiltered samples could lead to an over-estimation of PCB concentrations in ground water because even the PCBs attached to the soil particles suspended in the ground water sample get analyzed. In filtered samples, PCBs attached to the soil particles get filtered out, leading to lower concentrations of PCBs detected in the ground water samples. For better evaluation of the PCBs problem in ground water, both unfiltered and filtered ground water samples are analyzed. The Ground Water Quality Standards (GWQS) for PCBs, used by the New Jersey Department of Environmental Protection (NJDEP), are based on unfiltered sample results.

At Hexcel, both filtered and unfiltered ground water samples have been analyzed for PCBs. The high affinity of the PCB compounds to the soil particles is evident at Hexcel where much lower concentrations of PCBs were detected in the filtered samples as compared to the unfiltered samples. Out of the 7 wells tested in 1993 for both unfiltered and filtered samples, PCBs were detected in unfiltered samples from 5 wells in the range of 1.9 μg/L to 470 μg/L. On the other hand, PCBs were not detected in the filtered samples for six out of the seven tested wells. Only one well, CW-5, had PCBs detected for both filtered and unfiltered samples at 100 μg/L and 180 μg/L, respectively. Table C1 (Attachment C) provides the results of PCBs exceedances in the ground water.

Acid-Extractable and Base/Neutral Extractable Compounds

These compounds are together classified as semi-volatile organic compounds. The only well which had significant quantities of these compounds was CW-3. Based on the available data, semi-volatile organic compounds are not expected to be of significant concern at the site. Table D1 (Attachment D) provides the exceedances for semi-volatile compounds.

Metals

Metals in the ground water appear to be associated with the turbidity (from suspended particles) in the wells. Most of the wells on-site have silt accumulation at the well bottom. Metals, primarily arsenic, lead and nickel, were detected in exceedance of their respective GWQS in unfiltered ground water samples. Samples collected from MW-2 and MW-16 in 1988 indicated exceedances for some other metals also but repeat samples collected from these wells approximately 4 months later indicated that none of the metals exceeded the GWQS for these two wells. The reason for high metals results for the initial sampling round appears to be that the wells were sampled soon after installation and had higher turbidity as compared to the repeat samples collected after four months. Higher turbidity results from more suspended particles which can lead to an overestimation of metals in the ground water because even the metals attached to the suspended particles get analyzed. Table E1 (Attachment E) summarizes the metals exceedances.

Total Petroleum Hydrocarbons

Table F1 (Attachment F) provides the results of samples from 6 wells that had TPHs detected from the 22 wells that were analyzed for TPHs. The TPH concentrations ranged from 2,300 μg/L to 506,000 μg/L in these 6 wells. Unlike soil, there is no GWQS available for Total Petroleum Hydrocarbons (TPHs) in ground water. TPH concentrations tend to be related to the presence of LNAPL compounds like benzene, toluene, ethylbenzene and xylenes in the ground water.

Phenol

Phenols were detected in the most recent ground water sampling and testing. After the Napp explosion, some wells near Napp had elevated levels of phenols but did not indicate exceedance over the GWQS. Out of the 28 wells that have been tested for phenols, the only exceedance of the GWQS of 4,000 μg/L was for MW-8 for which a concentration of 6,256 μg/L was detected in 1988. All other detected results for phenols have been below the GWQS. Phenols were not detected in the stream samples collected in 1985.

Cyanides

Cyanide is another parameter that the monitoring wells were tested for to investigate the ground water. Cyanides were detected in very low concentrations in only 2 of the 19 wells tested. Cyanides were not detected in the other 17 wells and the stream samples. Therefore, cyanides are not considered to be of concern at the site.

2.3 LNAPL and DNAPL Characteristics

Ground water monitoring at Hexcel has indicated presence of both LNAPLs and DNAPLs in the subsurface. Figure G1 (Attachment G) shows the wells where LNAPL and/or DNAPL have been detected. Hexcel has been conducting product recovery from various monitor and recovery wells. The wells which indicate presence of product are monitored monthly. If a well indicates a recoverable amount of product (greater than one cup), it is monitored weekly. Additionally, most of the wells are monitored quarterly.

LNAPL

Ground water monitoring and product recovery data indicate that presence of LNAPL at the site is limited to very few wells. Table G1 provides the monitoring data for LNAPL and lists the thickness of the LNAPL layer observed in the wells. Even though LNAPL has been recorded to have been detected at 23 wells, for 13 of these wells LNAPL was detected only once between October 1990 and June 1997; for the other ten wells, LNAPL has been detected more than once during this period. Furthermore, LNAPL has not been detected in any of the wells since July 1996. The wells which have had LNAPL detected only once have not been considered as LNAPL wells in Figure G1.

Table G2 provides the actual recovery data for LNAPL from the wells. Table G2 tabulates data from October 1994; detailed data are not available for recovery efforts prior to this date. Amounts of LNAPL recovered have decreased significantly over time; more than 185 gallons of LNAPL was recovered between 1990 and 1992 and less than 10 gallons was recovered between October 1994 and June 1997.

LNAPL at the site is composed primarily of petroleum hydrocarbons like benzene, toluene, ethylbenzene and xylenes. Additionally, some DNAPL compounds like chlorobenzene and PCBs have also been detected in LNAPL. PCBs can be or become associated with LNAPL compounds and the resulting mixture can act as LNAPL. Table G3 provides the analytical data for LNAPLs.

Qualitative analyses of LNAPL recovered from some wells has indicated similar composition to that of No. 2 fuel oil. Fingerprinting analyses were performed on four LNAPL samples in 1991. These samples were collected from four locations: the area of fuel oil USTs, MW-23, CW-5 and CW-7. The sample from CW-5 was a thin layer of oil which separated from the discharge collected during a pump test at CW-5. The results were compared to gasoline and No. 2 fuel oil standard chromatograms. Samples from the first two sources (USTs and MW-23) indicated a similar composition to that of No. 2 fuel oil. Samples from CW-5 and CW-7 did not match the two standards (gasoline and fuel oil) and were also different from each other.

DNAPL

DNAPL has been detected more frequently and at more locations on-site than LNAPL. Table G4 provides the results of DNAPL monitoring. Table G5 provides the recovery data from October 1994 forward. There has been a significant decrease in the quantities of DNAPL recovered from the wells over time. Only 26.5 gallons of DNAPL were recovered between October 1994 and June 1997 compared to the 1200 gallons recovered between 1990 and 1991. The table below provides approximate amounts of total DNAPL recovered.

Period of Recovery	DNAPL Recovered (gallons)
Sept. 90 - Feb. 91	1000
Feb. 91 - Jul. 91	200
Jul. 91 - Apr. 92	70
Apr. 92 - Oct. 92	20
Oct. 92 - Aug. 93	10
Aug. 93 - Oct. 94	10
Oct. 94 - Jun. 97	26.5

Analytical results for DNAPL (Table G6) have shown the presence of chlorinated solvents like PCE, TCE, chlorobenzene, 1,2-DCA, 1,1,1-TCA and methylene chloride. Although PCBs were not detected in DNAPL samples from MW-6 (1988) and MW-26 (1994), a DNAPL sample from the DNAPL collection tank, H-7, had PCBs detected (Table G4). H-7 was used as a temporary DNAPL storage tank for the DNAPL recovered from the wells on-site.

2.4 Review of the Scope Of Past Investigations

This section provides details on the sequence of well installation at the Hexcel site and the different purposes for these wells. Additionally, we provide information on the ground water sampling that has been conducted on the site.

Sequence of Well installation

Hexcel installed three different series of wells to achieve three different purposes. Monitor wells were installed to investigate the ground water conditions at the site and control and recovery wells were installed as part of the remediation effort.

Monitor Wells

A total of thirty-three monitor wells (MW Series) were installed at the Hexcel site. Hexcel installed nineteen monitor wells (MW-1 through MW-19) between July 1988 and January 1989 as part of the ECRA investigation. Out of these 19 wells, there were seven (7) shallow-deep well pairs. Twelve more monitor wells (MW-20 through MW-31) were installed between September 1990 and February 1991. MW-32 and MW-33 were installed in April 1992. Out of the 33 wells, 8 are deep wells and 24 monitor the shallow formation; construction details on one well, MW-26, are unclear as to whether it is screened in the shallow or the deep formation. MW-32 was damaged by a snow plow and closed on March 29, 1996; it is scheduled to be replaced later this year.

Control Wells

Twenty shallow control wells (CW Series) were installed between July and September 1990. These wells were installed as part of the ground water recovery system.

Recovery Wells

A total of fifteen (15) recovery wells (RW Series) were installed for product (LNAPL or DNAPL) recovery purposes between August 1990 and February 1991. One additional well, RW1-1, was installed in October 1991 in the backfilled fuel-tank excavation subsequent to the fuel tank UST removal.

Other Wells

In addition to the above-mentioned wells, two piezometers were installed in the boiler room. Hexcel also installed three shallow wells in the Building 1 pit in June 1995 to evaluate the ground water recovery system.

Ground Water Sampling

Table A1 (Attachment A) lists the ground water sampling conducted at the site for each of the monitor, recovery and control wells. Thirty-one (31) out of the thirty-three (33) monitor wells present on site were sampled shortly after installation. Twenty-three (23) of these wells were sampled also in 1993. Some recovery wells and control wells have also been sampled. Additional sampling was conducted by Napp and Hexcel subsequent to the explosion and fire in May 1995 at the Napp property.